Patent
Attorney's Docket No. 030681-352

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	**MAIL STOP: AF**
Byung-kyu Lee	Group Art Unit: 1773
Application No.: 10/029,701	Examiner: HOLLY C RICKMAN
Filed: December 31, 2001	Confirmation No.: 3883
For: PERPENDICULAR MAGNETIC RECORDING MEDIUM	

DECLARATION OF BYUNG-KYU LEE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, the undersigned, hereby declare that:

1. I am named as the inventor in the above-captioned application.

2. I received Master degree in Magnetic Materials from Sung Kyun Kwan University

3. I have been working in the field of magnetic recording mediums for 14 years.

4. I have studied comments made by the Examiner in the Advisory Action of February 28, 2005, and in particular her comments regarding the soft magnetic layer of the Tang et al. patent (U.S. Patent No. 5,750,270) potentially acting as a perpendicular orientation promoting underlayer for its perpendicular magnetic recording layer.

5. I respectfully submit that a perpendicular orientation promoting underlayer of the present invention differs from the soft magnetic layer disclosed in the Tang et al. patent for at least the following reasons.

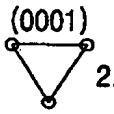
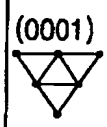
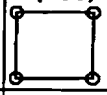
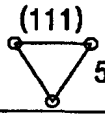
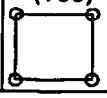
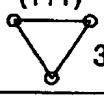
5A. A soft magnetic layer such as disclosed in the Tang et al. patent could in theory function like the perpendicular orientation promoting underlayer if its lattice parameter were substantially equal to that of a perpendicular magnetic recording layer. However, due to a great difference between the two lattice parameters, an amorphous layer is formed at the boundary between the soft magnetic layer or "keeper layer" 31 and the nucleating layer 32. Specifically, the soft magnetic layer 31 is disclosed as being NiFe (permalloy), which has a fcc structure and a (111) lattice parameter of 3.54Å. The Pd nucleating layer 32 of the Tang et al. patent has a fcc structure and a (111) lattice parameter of 4.49Å. A Co based recording layer, however, has a hexagonal structure and a (0001) lattice parameter of 5.01Å. The lattice mismatch between the perpendicular magnetic recording layer (5.01Å) and the soft magnetic layer (3.54Å) is too great (over 30%) for the soft magnetic layer to have appreciable influence on the perpendicular magnetic recording layer. Therefore, crystal orientation promotion by the soft magnetic layer composed of NiFe, as in the Tang et al. patent, would be trivial even if in direct contact to the Co based recording layer and would be virtually non-existent in the specific NiFe/Pd/Co or CoCr structure of the Tang et al. patent.

5B. Soft magnetic layers are formed so as to improve recording characteristics of a head when perpendicular magnetic recording is performed and contributes to an increase in the intensity of a practical recording field. In other

words, a soft magnetic layer enhances a perpendicular component of a leakage field of the head when recording to enable recording on media with high coercivity.

5C. The perpendicular orientation promoting underlayer suggested in the present invention acts as a seed layer for physically improving the perpendicular orientation (e.g., c-axial orientation) of the recording layer. More specifically, the present application discloses that a perpendicular orientation underlayer can be formed of Pt , for example, for superior perpendicular orientation.

Actual Lattice Parameter

Material	Structure	Lattice Parameter (Å)	Plane1 (Å)	Plane2 (Å)	JCPDS Card No.
Co (Recording Layer)	Hexagonal	2.5031	 (0001) 2.50	 (0001) 5.01	05-0727
Pt (Perpendicular Orientation Promoting underlayer)	FCC	3.9231	 (100) 3.92	 (111) 5.55	04-0802
NiFe (Soft Under layer)	FCC	2.53	 (100) 2.53	 (111) 3.54	

5D. The above table shows atomic structures formed when manufacturing perpendicular magnetic recording media. In the above Table, Plane 2 refers to a practical stack structure. The Co based layer, which is a recording layer, has an atomic spacing of 5.01Å, and the perpendicular orientation promoting underlayer according to the exemplary embodiments of the present invention has an

atomic spacing of 5.55Å. A lattice parameter mismatch between the two layers amounts to 10% and thus is relatively small. However, a lattice parameter mismatch between the recording layer and the soft magnetic layer, e.g., the NiFe layer, amounts to 30% and thus is relatively large.

5E. Even if the recording layer were grown on the exemplary NiFe layer, i.e., the soft magnetic layer, the recording layer would be crystallographically oriented independently of the NiFe layer. The Pt layer according to the exemplary embodiment crystallographically has a perpendicular orientation promoting property. The soft magnetic layer composed of NiFe, etc. does not serve as a perpendicular orientation promoting underlayer in the exemplary embodiments of the present invention that have a soft magnetic layer.

5F. Likewise, the CoCr recording layer grown after the NiFe layer, i.e., the soft magnetic layer, in the Tang et al. patent is crystallographically oriented independently of the NiFe layer. The Pd underlayer according to the Tang et al. patent crystallographically has a perpendicular orientation promoting property, while the soft magnetic layer composed of NiFe, etc. does not serve as a perpendicular orientation promoting underlayer in the embodiments disclosed in the Tang et al. patent.

5G. In summary, the perpendicular orientation promoting underlayer according to the present invention crystallographycally improves perpendicular orientation properties, whereas the soft magnetic layer disclosed in Tang et al. is designed to enable recording in media with high coercivity by enhancing the

recording field of a head when recording, but cannot be fairly described as a perpendicular orientation promoting underlayer for the reasons explained above.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Date: _____ By: _____
Byung-Kyu Lee